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ABSTRACT

This paper reviews the history of the work of the PME-NA Gender and Mathematics Working Group, and the progress made toward the intended end product of the Working Group. The first section, Introduction and Review, outlines the history and work to date of the group. The second section, PME-NA XXIV Session Goals, delineates the plans of the group for the PME-NA IV sessions. The third section, Review of Contributed Voices, includes abstracts of the 13 papers submitted for the monograph project and being reviewed and discussed in this year's conference sessions. These papers are organized into four categories: Reflecting on Voices in the Literature includes three literature reviews; Voices of Inquiry and Adolescent Girl includes three papers reporting on adolescent girls' experiences with mathematics; Voices from Post Secondary Classrooms includes three papers reporting on work in post secondary mathematics and mathematics education classrooms; and Voices (Re)Questioning where four scholars raise questions about the work we do and future directions for inquiry around gender and mathematics. (Author)

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# WORKING GROUP ON GENDER AND MATHEMATICS: GATHERING REFLECTIVE VOICES

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This paper reviews the history of the work of the PME-NA Gender and Mathematics Working Group, and the progress made toward the intended end product of the Working Group. The first section, Introduction and Review, outlines the history and work to date of the group. The second section, PME-NA XXIV Session Goals, delineates the plans of the group for the PME-NA IV sessions. The third section, Review of Contributed Voices, includes abstracts of the13 papers submitted for the monograph project and being reviewed and discussed in this year's conference sessions. These papers are organized into four categories: *Reflecting on Voices in the Literature* includes three literature reviews; *Voices of Inquiry and Adolescent Girl* includes three papers reporting on adolescent girls' experiences with mathematics; *Voices from Post Secondary Classrooms* includes three papers reporting on work in post secondary mathematics and mathematics education classrooms; and *Voices (Re)Questioning* where four scholars raise questions about the work we do and future directions for inquiry around gender and mathematics.

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## Introduction and Review

In all prior PME-NA Gender and Mathematics Working Group sessions from 1998 through 2001, we took the role of the "working group" to heart. We planned for the inclusion of *all* of participants in terms of being informed of the work to date and in participating in the work at hand. We plan and conduct the 2002 sessions similarly.

In 1998, at PME-NA XX in Raleigh, North Carolina, sessions centered around "Gender and Mathematics: Integrating Research Strands." We explored why we do the work we do and what we know from this work; what the compelling topics for future study are; and how we might further this work. Participants presented short papers and discussed connected issues. Organizer analyses of discussions revealed two main strands in the discussions: the "sex-gender system" and the "doing of mathematics." Participants created a web (see Erchick, Condron, & Appelbaum, 2000 for a visual representation of the web) to represent on-going work in gender and mathematics that illuminated for us the multidimensionalities of our scholarship. We concluded that the web represented research strands in gender and mathematics as well as new ways in which the group was thinking about the research strands.

In Cuernavaca, Morelos, Mexico in1999, our PME-NA XXI Gender and Mathematics Working Group sessions were devoted to discussion, with the organizers responsible for synthesizing and analyzing each day's work. The first session was

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framed by the summary of work at and since PME-NA XX and by work contributed by Dawn Leigh Anderson, Peter Appelbaum, Susanne K. Damarin, and Diana B. Erchick. In the second session, goals were set by the group: keep our work visible in the mathematics education community and work toward integrating our research findings into mathematics education and mathematics teacher education. Toward that end, we generated suggestions for how we might accomplish our goals: developing a monograph of our work; conducting research exploring practice; and, as suggested by Fennema and Hart (1994),pursuing research that is feminist and qualitative in nature. Participants developed an action plan and an organization for a call for papers for our monograph. Categories for the monograph included, but were not limited to the development of epistemological voice; the integration of gender research into the mathematics classroom, K-16; the integration of gender research into the mathematics education classroom; the role of the content in addressing gender issues in mathematics education research; mathematical success in fast-track and other programs for girls in mathematics; and mathematical success for women in mathematics and math-using fields.

At the 2000 PME-NA XXII Gender and Mathematics Working Group in Tucson, Arizona, we discussed in depth the ongoing work of all of the participants present at the sessions. This allowed us to understand some of the research that was already in progress by these working group members and to place that work within the context of the emerging themes of our intended monograph. We also developed a working thematic structure for the monograph where the concept of "Reflective Voices" guided the structure. We organized work around multiple perspectives that include researcher, historical, teacher, student and critical perspectives and these perspectives include feminist, methodological, self-reflective and empirical standpoints. We1) generated ideas for the distribution of a call for papers; 2) defined group member participation in the creation of the monograph; and 3) planned continued connection in professional meetings over the upcoming year.

At the 2001 PME-NA XXIII Gender and Mathematics Working Group sessions at Snowbird, Utah, we shared draft papers intended for the monograph and welcomed a number of new participants into our group. We discussed the emerging work in the sessions and many of us had the opportunity to continue those discussions beyond the confines of our sessions. We planned guidelines and timelines for progress toward the monograph and have been able to meet the goals set in that planning since we left the conference in Snowbird. We now have 13 scholars with papers in preparation or completed and submitted to our monograph editors.

**PME-NA XXIV Session Goals**

For this, the 2002 PME-NA XXIV Gender and Mathematics Working Group in Athens, Georgia, we are organized into two sessions. In these sessions, we anticipate that, as has been true in the years of the Gender and Mathematics Working Group at

PME-NA, new members will join our ranks; some with the intention of submitting work to the monograph; others seeking the opportunity for scholarly discussion We find these new members, their input, critique, questioning and insights, vital to the growth and development of our efforts in the group.

**Session One**

During the first session a review of the progress of the PME-NA Gender and Mathematics Working Groups is in order. The focus of that review is the working outline of our developing monograph, *Research, Reflections, and Revelations on Gender and Mathematics: Multiple Perspectives & Standpoints* (Erchick & Condron, 2001). We expect to critique the outline, review our submitted work for the project and determine how it reflects the essence of the monograph. We also plan to begin to review the submitted manuscripts. Working subgroups developed in this session will read, discuss and begin to provide feedback on and delineate needs of submitted papers.

**Session Two**

Session two participants will attend with a familiarity and working knowledge of the monograph outline and contributed work. Subgroups will devote the second session to peer review and feedback on the structure, analysis, conclusions, and implications of the submitted papers. It is the goal of the group that all submitted papers have this internal review, feedback and support before final revisions, editorial reviews, and full manuscript submission.

**Review of Contributed Voices**

When Suzanne Damarin and Diana Erchick started this project in 1998, an early result of the working group sessions was a graphic that revealed two conceptions determined by the scholars working within the group. One determination of the group was that the structure of our examination of the scholarly work of gender and mathematics was nonlinear and very complex. The other determination of the group was that there were absences in the field of study, and it would be part of our mission as members of the working group to pursue scholarly inquiry in directions that would begin to contribute to the field in the areas of those absences.

As we collect, review and organize the work our members have been conducting over the past few years, we do so with an "attunement " to the voices of the teachers, students and scholars participating in the work. As Erchick & Kos (in press) explain, "attunement implies a deliberate focus on particular concepts and the voiced representations of them. It is a special way of listening, a special way of hearing. It requires knowledge and understanding of the concepts heard as well as an effort to hear." Our attunement reveals both our committed effort to focus on participant voices in our work and the scholarly understanding we bring to that hearing. Following are examples of the work we now bring to this project. This project is not intended to be

a comprehensive satisfaction of the need to address the absences we have identified in the field of gender and mathematics; it is, however, intended to be a beginning.

**Reflecting on Voices in the Literature**

In her contribution, Research and Reflections on Women Leaving Post-Secondary Mathematics, Abbe H. Herzig writes from the Graduate School of Education at Rutgers University. In her work she writes how women and members of some racial and ethnic groups are underrepresented at higher levels of education in science, mathematics, and engineering (SME). That is, at each educational stage, disproportionately fewer members of these groups persist in the study of SME disciplines. This is a concern both because of our need to ensure equitable and fair opportunities for all individuals, and because of the loss of the contributions that these students might otherwise make. Herzig explains how research effort has been invested in examining the loss of these students—particularly women—from particular stages of the SME educational "pipeline," but few studies have focused particularly on mathematics. In her review, she draws out the parts of that research that are relevant to mathematics in particular, and reviews the research about females leaving mathematics. This review synthesizes research from various educational stages to present a longitudinal picture of women leaving mathematics, beginning in high school and throughout college and graduate school. Herzig includes her own reflections as a woman who left mathematics, and kept coming back, several times.

Linda Condron, from The Ohio State University, contributes a review of literature "stories" about women and the technical realm. There are stories throughout history that demonstrate women have always been active with/in science, mathematics, and technology. For example, Hypatia of Alexandria is famous for her work in algebra; Ada Lovelace wrote the first computer programs; and Grace Hopper was instrumental in the creation of modern computers and programming languages (Alic, 1986; Rossiter, 1982; Stanley, 1983). There are also stories of the consistent absence of women from the technical realm. Less than a hundred fifty years ago, many people believed that women's reproductive organs would be damaged if they studied mathematics and science (Solomon, 1985). Women were excluded from such study by official policies barring their access to formal education in many high schools, colleges, and engineering schools (Hacker, 1983). A story encountered by women in technical professions in our own times is that of marginalization. In the 1970s, women entered technical professions in record numbers. However, statistics indicate these well-educated women, working in the technical realm of, today experience lower status and pay than their male counterparts (NSF, 1996). A compelling story can be gleaned from the writings of women like Evelyn Fox Keller (1985) who showed how science and the scientific method was conceptualized in 17th century Europe. Examining the metaphors used for science and technology, Keller reveals a story of science defined as male, a story within which women have no place from which to engage with/in the technical realm

without calling into question their very identities as women (Harding, 1986; Keller, 1985).

Another story about the relationship of women to mathematics and technology is one of how mathematics came to be a school subject, to be important in engineering education, and to be used as a "critical filter" that excludes women and certain other groups from technical educational opportunities (Cohen, 1982; Hacker, 1983; Sells, 1992). Condron interprets this vast and complex literature as numerous competing stories, sometimes overlapping, sometimes contradicting one another (Condron, 1997; Haraway, 1991; Lather, 1991).

Dawn Leigh Anderson, from California State University at Fullerton, contributes a theoretical framework that draws upon the literature on feminist standpoint theory. In A Theoretical Framework for Inquiry: Feminist Standpoint Theory and Its Application to Mathematics Education, Anderson discusses a feminist epistemological framework by beginning with the point that there is no one feminist epistemology. She admits to the many and diverse feminist epistemological frameworks and that nowhere will we find one true feminism or feminist epistemology. The feminist theoretical framework that Anderson relies upon in her work is feminist standpoint theory, one that most aptly describes the lens through which she approaches her work. She first provides an overview of feminist standpoint theory in order to familiarize readers with its main tenets; then she discusses the application of feminist standpoint theory to mathematics education.

Anderson cites Nancy Hartsock's (1983) introduction of a "feminist standpoint" and traces the origins of standpoint theory in feminism back to Marxist thought, where the idea that the proletariat maintains a standpoint that is unique to the working class. Her points are made with a rich literature of feminist scholarship as she explains the tenets of feminist standpoint theory through discussion of women as constructors of knowledge; privileged epistemic viewpoint; agency; objectivity; and multiplicity. As she moves her discussion into mathematics education, Anderson includes topics like females as the focus of inquiry, mathematics as a gendered process, diversity, learning as a reciprocal activity, voice, agency, and authorship. She includes a discussion of epistemological perspective of mathematics within feminist standpoint theory and addresses the issue of "the risk of essentialism." She draws on the work of scholars such as Burton (1995; 1999), Confrey (1994; 1995a; 1995b; 1999), Damarin (1990; 1995), Fuss (1989), and Rogers and Kaiser (1995). Anderson is committed to the idea that there is no single feminist perspective of doing, knowing, and learning mathematics. She strives to understand the diverse and multiple experiences of girls in feminist mathematics classrooms. She explores patterns and examines how those patterns affirm girls' experiences in a feminist mathematics class.

**Voices of Inquiry and Adolescent Girls**

Jae Hoon Lim, from the University of Georgia, contributes her paper, Sociocultural Contexts of Learning School Mathematics: Impact of Social/Cultural Capital

on Girls' Motivation and Identity to this project. The theoretical framework of this study is derived from the recent accomplishments of social constructivism and critical ethnography in education. Lim identifies critical perspectives that argue the case that education helps to maintain the status quo. Practices and structures marginalize or deny groups of people from society's influential positions. These groups of people include women, minorities, and members of low socioeconomic classes. She cites scholars such as Apple (1988), Calhoun (1993), Harter, Waters, and Whitesell (1997), Oakes (1990; 1992) in her arguments.

The work she reports upon here is a cross case study. Lim explores two young adolescent girls' experiences with school mathematics. The impact of the sociocultural context upon their motivation and mathematical identity is a focus. Lim conducted repeated in-depth interviews and ethnographic observations of the girls' mathematics classroom, and portrays two contrasting pictures of young adolescent girls who come from different ethnic, economic, and cultural backgrounds. The interview data revealed three themes. One is that the girls' experienced an anxiety that was grounded in the school mathematics culture. A second theme is that social and cultural capital contributed to the girls' motivation and identity construction. The third emergent theme for the girls is the "problematic dislocation between their social world and their experience with school mathematics."

Lim reports that "[t]he overall data analysis reveals the profound impact of social/cultural capital upon the girls' experiences with school mathematics well as their construction of identities in the discipline" and " illuminates the ways in which various sociocultural factors and forces dynamically impact aspects of their identities and motivation for learning school mathematics."

Ann C. Howe and Sarah B. Berenson report from the Center for Research in Mathematics and Science Education at North Carolina State University. In their paper, Talented Girls Talking About Their Attitudes, Experiences and Expectations in Mathematics, they describe work that focuses on twelve middle class, mathematically talented girls' as they talk about their attitudes, experiences and expectations related to mathematics. They also ask whether teachers see the girls as the girls see themselves. The paper is based on interviews of girls who participated in Girls on Track, a summer and follow-up program for ethnically diverse middle school girls who are enrolled in upper level math courses, and the results of a survey of teachers and counselors in the project. Howe and Berenson interviewed the girls and coded their data for interest, motivation, confidence, parental (and others') support, readiness, general self esteem, usefulness of mathematics and career plans. They also asked the girls to respond to a written questionnaire; teachers and counselors responded to two similar forms of the instrument, one to assess attitudes toward girls and mathematics, the other to assess attitudes towards boys and mathematics.

The results of the interviews confirm what is expected for girls who are on the upper math track. In their own words they tell us that they like math, their parents

expect them to do well and they are willing to put forth the necessary effort to maintain good grades. Most of them are self confident, optimistic, have many interests, are involved in a variety of activities, have thought about their futures and expect to have professional careers. When Howe and Berenson analyzed the teachers' and counselors' responses to the survey instrument they found no significant difference in attitudes toward boys and girls in math. However, they found that the girls scored themselves somewhat higher in every category than teachers and counselors scored girls. That is, the girls are more interested, confident, motivated, and aware of priorities, stereotypes and gender than their teachers believe girls to be. The paper explores and reflects on these findings.

Diana B. Erchick contributes a report from an evaluation of a summer mathematics camp project implemented through The Ohio State University. Her paper, *Matherscize Camp for Middle Grades Girls: Reflections on Content and Process*, describes the perceptions of girls and teachers who participate in the camp, and the parents of the girls who participate. The camp is a weeklong summer project where lessons integrate mathematics with science, art and literacy. The Matherscize program intends to support the mathematical development of its participants through implementation of research-based curriculum and instruction and informed pedagogy.

Erchick explains how, to support understanding and connection in mathematics, the Matherscize camp focuses on providing meaningful mathematics experiences based on three criteria: 1) a curriculum and pedagogy grounded in recommendations of the learned societies and their research-based recommendations both for pedagogy and equity (NCTM 2000; Erchick, 2002a); 2) support for a process-based epistemology (Erchick, 2002b) in understanding the content of mathematics; and 3) development of community by girls during their school experiences with mathematics. Erchick conducted the evaluation from an interpretivist perspective (Denzin, 1989; Schwandt, 1994), a methodological focus that was particularly relevant in terms of generating findings grounded in students' interpretation of the experience of mathematics education – what role the content plays in their development; how meaningful the content is in their lives; how it does or does not contribute to the students' quality of life; how selected pedagogies and supports serve their needs; and how the girls interpret efforts to support their continued networking around mathematics.

All data collected for evaluation purposes was a part of the usual implementation and evaluation of the camp and consisted of application essays, daily writing samples, work products from the camp, feedback questionnaires from parents, and students and teachers participating in the camp. Erchick's analysis revealed the presence of a process-based epistemology and the ways in which the camp's pedagogical focus supported that epistemology. Analysis also revealed how the girls attending the camp perceived the social connections made in the camp to be important and meaningful. It is not inconsequential that the social connections centered on mathematics experiences.

**Voices from Post Secondary Classrooms**

Dorothy Buerk, from Ithaca College, contributes work entitled "Listening to Women in College Mathematics Classes." In quotations from remarkably articulate women, she hears a metaphor of math as a stainless steel wall, offering no handhold, on which are written innumerable God-given rules of mathematics. She also hears "'math is not a place for ideas in process'" (Buerk & Szablewski, 1993, p.152); and "'there seemed no room for interactions with the content, no possibility of connection with the ideas'" (Buerk & Szablewski, 1993, p.151).

Many students believe that mathematics is made up only of rules, formulas, and proofs to be memorized; skills to be practiced; and methods to be followed precisely. They believe that mathematics is a discipline where certainty is secure; where all questions have answers, which are known to authority (mathematician, professor, TA, textbook); where memorization, hard work, and some mystical quality called the mathematical mind are required. Buerk hears mathematicians report that the way mathematics is taught in the traditional classroom, in textbooks, and in their professional writing is the public image of mathematics. However, the way mathematicians do mathematics–the private world of mathematics–is intuitive, contextual, and narrative, involving experiencing the problem, relating it to their personal lives, and examining and resolving ambiguities (Buerk, 1985). Buerk relates this gap between the conception of mathematics of many students and the conception of mathematics often held by mathematics educators to the theories of Perry (1970, 1981) and Belenky, Clinchy, Goldberger & Tarule (1986). In her research, she presented women a series of mathematical experiences to encourage growth in conceptions of mathematical knowledge through successive positions in Perry's scheme, and observed parallel progression toward personal responsibility for their own learning, with mathematics becoming more approachable for them (Buerk, 1981, 1982). In the absence of such classroom experience of mathematics, Buerk is compelled to return to the provocative question posed by Elizabeth Fennema, "Is it possible that females have recognized that mathematics, as currently taught and learned, restricts their lives rather than enriches them?" (Fennema, 1994).

Kathleen L. Bonn, from Michigan Technological University has contributed a paper entitled What Factors Affect Women's Decisions to Pursue Graduate Degrees in Mathematics? In this work Bonn discusses nine college seniors, all women majoring in mathematics at a mid-size Midwestern research university. She points our that currently 50% of the bachelor's degrees in mathematics are now going to women; but given that so many women now major in mathematics, it is unusual that not one of these nine women had plans to pursue a graduate degree in mathematics. They had come to dislike mathematics, yet planned to get a job teaching high school mathematics.

Bonn's objective in this study was to understand how senior female mathematics majors made decisions about continuing on in mathematics. She conducted in-depth

individual interviews and focus group interviews. Through the interviews Bonn asked participants questions regarding their educational histories in high school and college mathematics. She asked also questions about role models and questions about future plans. In additional interviews, seven particpants with high grade point averages, and thus the background to enroll in graduate-level mathematics programs, were asked to focus directly on the questions, "What are the factors that directly or indirectly influenced *your* decision on whether or not to attend graduate school in mathematics?" and "What are the factors that could directly or indirectly influence *other female math majors*' decisions on whether or not to attend graduate school in mathematics?" Bonn found three major factors which affected these women's decisions: (lack of) confidence in one's ability to do graduate-level mathematics, (lack of) perceived usefulness of a graduate degree in mathematics, and (lack of) enjoyment in mathematics. Bonn makes two recommendations: encourage more women to attend graduate school in mathematics and support mathematics education majors so that they will reenter high school classrooms enthusiastic about mathematics and confident in their abilities to foster this love of mathematics in their own students.

Hea-Jin Lee, from The Ohio State University at Lima, contributed The Evolution of Prospective Teachers' Perceptions of Teaching. She reports on work with preservice elementary and middle school teachers. Lee analyzed interviews, journal entries and concept maps, to investigate changes in the total number of items on the maps; the number of item streams (superordinate concepts close to the central concept); hierarchical organization; increased similarity to one another; use of technical vocabulary and frequently used terms introduced in the program.

Lee's findings point to the importance of understanding preservice teachers' prior beliefs to inform supervision and university course design; the need to routinize classroom management knowledge before attending to subject-specific pedagogy; and the importance of the academic task as part of the teaching knowledge base. Many students listed terms such as lesson preparation, attention, enthusiastic teaching, and teaching aids. Other frequent item streams included humor, reinforcement, and classroom management. There was a general lack of technical vocabulary evidenced on the maps, as well as a lack of detail and hierarchical organization.

Lee cites Pajares (1993) with suggestions for several approaches to challenging beliefs; and the work of Feiman-Nemser and Buchmann (1989) to discuss the tension between challenge and support, assimilation and accommodation, tensions that must be tolerated and cultivated. Lee discusses preservice students' evolution; connections between teacher beliefs and how they choose to teach (Anning, 1988); and research on changing beliefs and teaching patterns to make them more constructivist and student oriented. This work becomes particularly significant when considering the demographics of preservice programs. With females dominating the profession, the issue could very well become the ways in which women in the profession perpetuate beliefs about mathematics and how they use those beliefs to shape instruction for student

learning. Indeed, how might these teachers teach the young in their care to learn to see mathematics? If the teachers approach mathematics as they do in Lee's study, women in elementary and middle grades education may model and teach their own beliefs and understanding, found in Lee's work to lack technicality, detail and hierarchical organization.

**Voices (Re)Questioning**

In her work at the University of Wisconsin-Madison Ólöf Björg Steinþórsdóttir studies students' strategies in solving proportion problems and the influence of problem semantic type and number structure on the use of strategies. Steinþórsdóttir also examines gender differences in strategy use. For the work she discusses for this project, she interviewed twenty-seven females and twenty-six males - all eighth grade students in one school in Reykjavik, Iceland. The problems used in her study represented four semantic structures, four problems of each structure. Each problem represented a distinct number structure. Steinþórsdóttir finds that number structure influenced strategy use and success to a greater extent than semantic type.

In her paper, *Less sophisticated girls? Or less sophisticated analysis,* Steinþórsdóttir's analysis does not end with strategies and successes. With a cognitive lens in analysis, Steinþórsdóttir focuses on "sophistication" of strategy and strategy use. She finds no gender differences identified in the overall success rate at solving these problems. Girls were more successful than boys in associated sets and symbolic problems; and boys more successful than girls in part-part-whole problems. Girls and boys used different types of strategies for all semantic types except the symbolic. Data suggest the semantic type influences females' choice of strategy more than that of males.

Steinþórsdóttir problematizes her analysis and looks at how this traditional cognitive analysis portrays a deficit model of girls. It therefore sustains the common belief that girls don't do as well as boys in math. After analysis she critiques her own analysis, presentation of results, and the discourse used in her reporting. Her intention is to reconstruct the terms less and more sophisticated and less and more mature strategies, toward more gender-fair implications and a new discourse for discussing girls' and boys' achievement in mathematics.

Suzanne K. Damarin, from The Ohio State University, in her paper, As the World Turns: Salient Issues on the Study of Gender and Mathematics, discuss both a linear progressions model and a "world turning" metaphor to discuss models of research around gender and mathematics. The linear progressions model begins with a set of findings and uses that one set of findings to build upon another. It includes the idea of progress, of one day coming to a final solution. The world turning metaphor is a cyclic one that Damarin finds more suitable for the study of gender and mathematics. In this model, each new day/season/year researchers in the field of gender and mathematics find the same issues and experiences as they have always found. Instead of this indicating an endless circle, the model indicates constant (re)encounters with concepts

that are changing in the always new situations, always evolving contexts for returning issues of equity, power, agency, and voice.

Damarin starts her discussion with multiple critiques: of sex versus gender, essentialism in multiple venues, the denial of agency, and mathematics as a male domain. She then moves to a discussion of postmodernism as "both a condition and a philosophy, a mode of thought, a way of knowing." From this perspective, she returns to the critiques in the earlier part of her paper. Damarin deconstructively reconsiders those critiques in one reprise after the other entitled Both Sex and Gender, Anti-Anti Essentialism, Subjected Positions, and Maleness as a Mathematical Domain. She closes with thoughts on the promise for the future with regard to Technology, Cyber Feminism, The Information Age, and Cultural Change.

Bob Klein, from The Ohio State University, in his paper, *Computer Calculus: Integrating Technology (with respect to sex),* interrogates issues that lie at the intersection of technology, gender issues, and pedagogy. He asks the questions; How are pedagogies identified as being "female-friendly" or "feminist" enacted within a calculus reform classroom; How are feminist transformative desires approached by the enactment of these pedagogies? How are pedagogies contextualized? What implications arise from looking at ways in which pedagogies reflect (or not) the inclusive aims of feminist pedagogies and how accurate is the repeated use of "for all" as a label of inclusivity within educational discourse? Klein asks his questions of the site in terms of how the pedagogy was mediated by the use of technology. Klein collected data from a variety of sources surrounding a computer calculus course at a large Midwestern university in fall 2000. He identifies "Female-friendly" or "feminist" pedagogies are educational practices as having great potential to transform existing social relations thereby making our classrooms environments that embrace human diversity. Yet, taken uncritically or applied superficially, these techniques, when blindingly applied "for all" can serve ends that are counterproductive to feminist transformative desires.

Peter Appelbaum, from Arcadia University, contributes "What Do We Learn From Critical Theory and Media Studies?" and asks us to construct questions about power, knowledge, and social change. He discusses the increasing sophistication of our comprehension of gender issues in mathematics and how that gets reduced to popular, common sense pronouncements on the need of female students for special help; and the need for funding for innovative programs that "solve the problem." Appelbaum explains that the" increasing sophistication" comes from a consistent program in feminist epistemology and critique of mathematics as a disciplinary project and curricular encounter (e.g., Barton, 1998; Damarin, 1995). Strides made in reframing questions get translated in the mass culture as a threat to the commonsense notion that a neutrality and skill-based body of facts and procedures define mathematics. Any attempt to make mathematics meaningful, relevant or intellectually engaging for all becomes "a discursive interjection in the math wars debate between two constructed

poles: traditional and "fuzzy" math." Special classes for girls sustain beliefs that the end result must be the "real," or traditional curriculum and girls should be compared as a category to norms outside the category. "Even if the objectives of a special program for girls adhere to standards of 'workplace readiness' and basic skill levels, however, the program itself can never be a model for the standard curriculum, but is doomed to special 'remedial' or 'epidemiologically preventive' status." Efforts to promote "girl power" and celebrate the accomplishments of girls and women in mathematics, serve to recreate glass ceilings for participation and performance while introducing new infrastructures and challenging the goals of traditional school programs.

Appelbaum points to an unbalanced view of the scenario on cultural change and social action, a view once posited by the anthropologist Marshall Sahlins (1985). People act to maintain social structure, but must change things to maintain that structure. Appelbaum makes the point that "what critical theory can help us with is the importance of power in the acting out of such action and social change. It is essential that we ask how knowledge is constructed as canonical or central to school practice, and why other knowledge is not."

## Closing

In pursuing inquiry around the absences in the research on Gender and Mathematics, the PME-NA Gender and Mathematics Working Group participants have committed themselves to an interpretation of the field of gender and mathematics as complex and nonlinear. We have also chosen to investigate the absences we encounter with a respect for the reflective voices of the researchers, teachers, students, women and girls who contribute to the work. In the papers and processes of this project, we work consistently to respect the structure and voices that emerge.

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